MICROMITE™ & MICROMITE™ PLUS INDICATOR/CALIBRATOR'S SERVICE MANUAL

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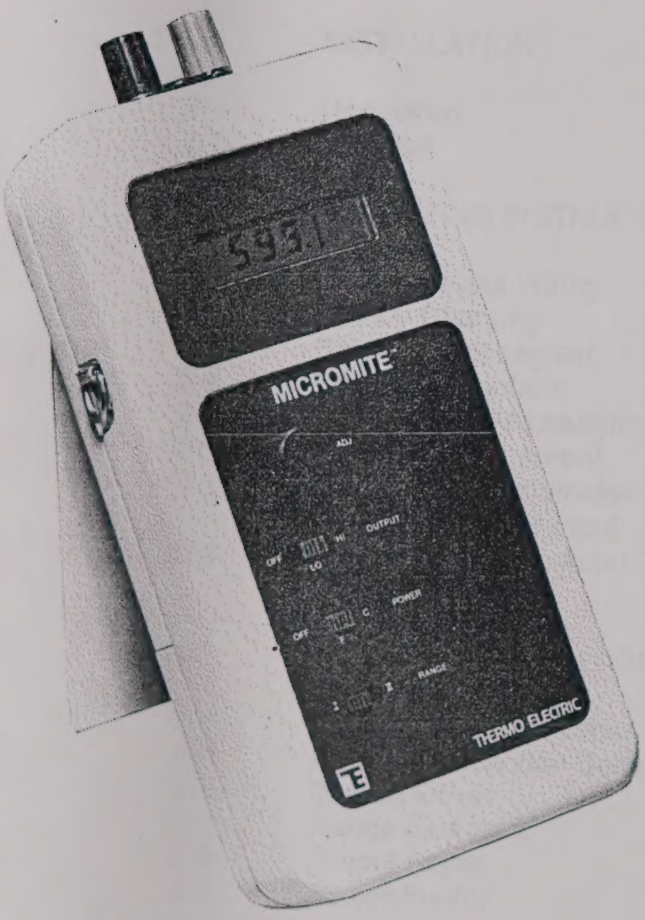

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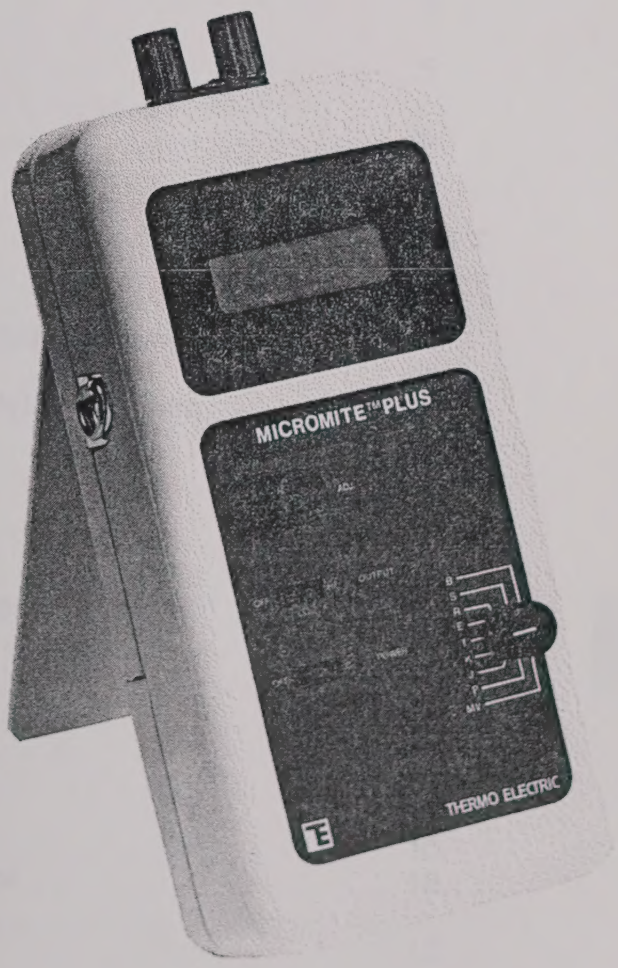

MICROMITE PLUS

THERMO ELECTRIC

E2348

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1-0 DESCRIPTION

1-1 Introduction

This manual contains all the information normally required to operate and maintain the portable Micromite digital temperature indicator/calibrator. Always refer to the serial number and model number on the label attached to the case in correspondence or when ordering replacement parts, so that the unit can be properly identified.

Micromite is provided in several basic designs as listed in Section 1-5. Should you require additional information beyond what is contained in this manual, contact your local Thermo Electric Applications Engineer or our main office in Saddle Brook, New Jersey. For service information contact:

Thermo Electric Co., Inc.
109 Fifth Street
Saddle Brook, New Jersey 07662
ATTN: Instrument Service Manager
Phone: (20l) 843-5800

1-2 General Description

The Micromite is a highly accurate, compact and portable instrument which can be used to:

1. Measure temperature directly, using a thermocouple
2. Measure millivolt signals directly
3. Calibrate potentiometer type instruments
4. Calibrate laboratory instruments

Micromite is a portable, dual calibration instrument with built-in reference junction compensation. The unit automatically displays the hot junction temperature of the attached thermocouple. Standard thermocouple calibrations are available covering the complete temperature span for that thermocouple as shown in the Calibration, Ranges & Accuracy Chart (see Section 1-4). In addition, a millivolt range is offered. Resolutions offered are either 1 or .1 degree F or C or .01 millivolts.

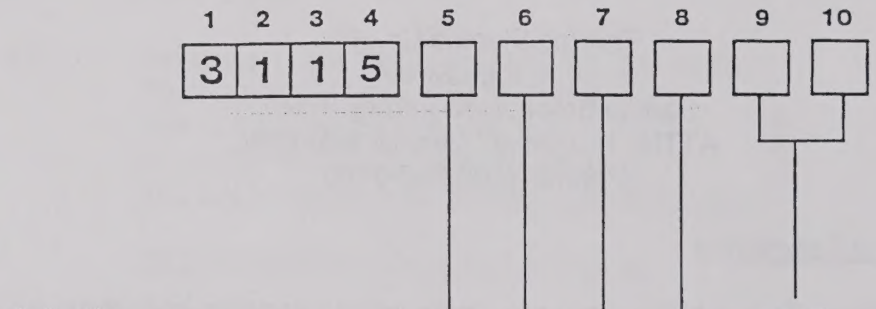
Power required by Micromite is supplied by a rechargeable nickel cadmium battery pack. This battery pack can also be replaced in the field so that spare fully charged battery packs can be inserted eliminating the need for operating the unit with a recharger attached.

The battery recharger/AC adapter cord (115 Vac standard, 230 Vac optional) is included with the Micromite. It has a special 90° receptacle to differentiate it from other rechargers. This also facilitates using the Micromite with the recharger attached, when it is set up on its own self-contained stand in a laboratory or office.

NOTE: Other rechargers may be plugged into the Micromite inadvertently since the receptacle is a standard size. These rechargers may damage the unit, and will not recharge the unit. Therefore, recharge unit only with 115 Vac recharger provided (TE Part #A9257), and clearly identified as a Micromite recharger. For 230 Vac operation use recharger #A9380.

1-3 Description Code

The following identification table explains the instrument model number found on the Micromite.



Calibration
1 - Single Calibration
2 - Dual Calibration

Range I Calibration - NC
J - Iron Constantan
K - Chromel Alumel
T - Copper Constantan
E - Chromel Constantan
R - Platinum - 13% Rhodium vs. Platinum
S - Platinum - 10% Rhodium vs. Platinum
B - Platinum - 30% Rhodium vs. Platinum - 6% Rhodium
M - Millivolts

Resolution
0 - 1° Resolution
1 - 1° Resolution

Case*

Range II Calibration - NC
0 - For single calibration
J - Iron Constantan
K - Chromel Alumel
T - Copper Constantan
E - Chromel Constantan
R - Platinum - 13% Rhodium vs. Platinum
S - Platinum - 10% Rhodium vs. Platinum
B - Platinum - 30% Rhodium vs. Platinum - 6% Rhodium
M - Millivolts

*Standard Micromite package includes shoulder strap, case, 115 Vac battery recharger and battery pak.

Sensor Type	All ISA calibrations, RTD DIN curve 43760 (∝ = 0.0035 ohms/ohms/°C).	Resolution	Accuracy *	
			Degrees	% of Span
J	-196°C to 913°C / -320°F to 1675°F	.1°F	±0.7°F	± .04%
		1°F	±1.0°F	± .05%
		.1°C	±0.4°C	± .04%
		1°C	±1.0°C	± .09%
K	-190°C to 1371°C / -310°F to 2500°F	.1°F	±0.9°F	± .03%
		1°F	±1.0°F	± .04%
		.1°C	±0.5°C	± .03%
		1°C	±1.0°C	± .06%
T	-196°C to 399°C / -320°F to 750°F	.1°F	±0.9°F	± .07%
		1°F	±1.0°F	± .09%
		.1°C	±0.4°C	± .07%
		1°C	±1.0°C	± .07%
E**	-196°C to 788°C / -320°F to 1450°F	.1°F	±0.9°F	± .04%
		1°F	±1.0°F	± .05%
		.1°C	±0.5°C	± .04%
		1°C	±1.0°C	± .08%
S****	-1°C to 1760°C / 30°F to 3200°F	.1°F	±1.7°F	± .05%
		1°F	±2.0°F	± .06%
		.1°C	±0.9°C	± .05%
		1°C	±1.0°C	± .06%
R****	-1°C to 1760°C / 30°F to 3200°F	.1°F	±1.7°F	± .05%
		1°F	±2.0°F	± .06%
		.1°C	±0.9°C	± .05%
		1°C	±1.0°C	± .06%
B	538°C to 1760°C / 1000°F to 3200°F	.1°F	±1.8°F	± .08%
		1°F	±2.0°F	± .09%
		.1°C	±0.9°C	± .07%
		1°C	±1.0°C	± .08%
P (RTD)	-196°C to 816°C / -320°F to 1500°F	.1°F	±0.7°F	± .04%
		1°F	±1.0°F	± .05%
		.1°C	±0.4°C	± .04%
		1°C	±1.0°C	± .09%
M*** (Millivolts)	-9.99 to 90.00 mV resolution .01 mV accuracy ± .01 mV			

*Accuracy Figures for one degree resolution Micromites are rounded up to the nearest degree.
**1450°F/788°C output limit on E ranges, display limit 999°C/1830°F.
***60.00 mV output limit on millivolt range.
****Accuracy figures shown are for the range of 200°F to 3200°F.
For measurement less than 200°F double the values shown.
Accuracies shown are based on tests at 25°C ambient temperature.

1-4 Micromite Specifications

Accuracy & Conformity: See Figure 1-1
Resolution: 1 degree or .1 degree
Ambient Operating Temperature: 10°C to 55°C for J, K, T and E, B, M calibrations; -1°C to 55°C for R, S calibrations
Normal Mode Rejection: 50 db
Common Mode Rejection: 125 db (with recharger)
Input Leakage Current: 10 nanoamperes Max
Source Resistant Effects: 1μV error/100 ohms source resistance
Measurement Time: 3 conversions/second for 4 conversions followed by 1 sec max RJC measurement
Input Impedance: 100 megohms minimum
Battery Pack Type: 4.8 V Nom. 4 x 1.2 AHR SC Cell Nickel Cadmium Pack - Field replaceable
Battery Life: To 5 hours continuous or 600 temperature checks
Battery Recharge Time: 16 to 18 hours (overnight)
Temperature Stability: 76 PPM/°C of reading
Zero Drift: .13 μV/Deg F
Damaged Probe/Overrange or Underrange: Indicated by "HI" or "LO" respectively
Weight: 33 oz.
Dimensions: 7 1/2" H x 3 3/4" W x 1 15/16" D
Case: White die cast aluminum
Display: .33" LCD, 4 or 5 digits depending on resolution, automatic leading zero supperssion
Discharged Battery Display: "Help" all models
Recharger Voltage 115 Vac, 50/60 hz. (230 Vac optional)
Cold Junction Compensation: Automatic .02 DEG/DEG J, K, T, E .05 DEG/DEG R, S, B
Display Symbols: Automatically indicates °F, °C or mV depending on range selected
Source Mode Impedance: 50 ohms
Source Mode Output Range: -12 mV to 25 mV and 25 mV to 60 mV (J, K, T, E)
(2 ranges) -4.8 mV to 10 mV and 10 mV to 24 mV (R, S, B)
Linearization Segments: J(58), K(79), T(60), E(71), R(89), S(83), B(66)
Storage Temperature: -50°C to +90°C for Micromite
-40°C to +60°C for maximum battery life

2-0 INSTALLATION

2-1 Unpacking

Unpack the instrument immediately upon receipt and check for shipping damages.If damaged, immediately report the damages to the carrier. Replace the instrument in its shipping container until ready to use. Sometimes, instruments are shipped with small accessory items in the same box. Check all items against the packing list before discarding the shipping container and packing material.

2-2 Location

The Micromite is a portable instrument which can also be used on tables or benches. It is readily transported, but it should be kept in the protective carrying case whenever possible. It is operable over the ambient temperature limits of -10°C to 55°C for J, K, T, E, B and M calibrations and -1°C to 55°C for R and S calibrations.

3-0 OPERATING INSTRUCTIONS

3-1 Thermocouple Wiring

The thermocouple input wires are attached to the input binding posts on the Micromite.

NOTE:Care must be exercised when connecting the thermocouple leads to ensure the correct polarity. If a shielded thermocouple is used, it is recommended that the shield be returned to the black (+) input terminal of the Micromite, along with the positive thermocouple lead.

3-2 Battery Charging

To charge the battery pack, insert the battery charger plug into the "RECHARGE' jack on the bottom on the Micromite and then plug the opposite end into the AC line.

Use the 115 volt charger on 115 volts only. If only 220 volts is available, the optional charger should be used.

NOTE: Care must be exercised to insure that the plug is firmly seated in the connector. The Micromite may be run with the battery charger connected. For maximum battery life, it is recommended that the unit be charged only when the discharged battery indication (display indicates HELP) is observed. Charge unit upon unpacking or before initial use to insure a full charge on the Battery Packs.

3-3 Battery Replacement

Place the Micromite face down on a clean, flat surface. Turn the locking screw on the bottom of the unit to release the self-enclosed bench stand. Raise the bench stand to expose Battery Replacement Instructions on the lower removable section of the rear cover. Loosen, without damaging the battery recharger receptacle, two (2) captive screws from this cover. Remove the cover, and turn it over carefully to expose the plastic battery compartment. Carefully unsnap the yellow battery pack from the plastic holder. Do not strain the connecting wires. Disconnect the polarized terminals on the red and black wires between the battery pack and the printed circuit board. Grasp the connecting terminals rather than pulling on the wires themselves.

Snap the new battery pack into the plastic holder. Reconnect the red battery wire to the red lead from the printed circuit board and the black battery wire to the black lead. The terminal itself is polarized so that the wires can only be connected properly.

CAUTION: DO NOT allow the red and black leads from the battery to touch. This will result in a short which can melt the wires and permanently damage the battery pack.

Now, carefully tuck in the wires and reassemble the battery holder and metal cover, exercising care not to crimp or crush any of the wires under the cover. Tighten the two (2) screws on the cover. Fold down the bench stand and turn the locking screw to hold it in place. The Micromite is now ready to use. The removed battery pack can now be fully recharged out of the unit for subsequent use by using Thermo Electric 115 Vac mating adapter Part No. A9381.

3-4 Operating Controls, Micromite

The rear panel on the Micromite includes all the operating instructions to use the unit properly. Following are more detailed instructions. Always make sure first that the positive thermocouple leads are connected to the black terminal and the negative thermocouple leads to the red terminal.

This switch selects whether the Micromite is used to indicate (read input mode) or calibrate (output mode) a thermocouple circuit. In the off position, the unit functions strictly as an indicator or reading instrument. This is the normal operating mode used to indicate temperature or millivolts. To output a signal, place the switch in either "Lo" or Hi", for Lo and Hi span respectively. Details of each span may be found on the label on the rear of the instrument. (Make sure that the selected span corresponds with the thermocouple calibration being used.)

In the output mode ("Lo" or Hi"), the black and red terminals are driven with a voltage that may be varied by turning this Adjust knob. When the Output Mode is used with a thermocouple range, the reference junction is functioning and a compensated millivolt equivalent of the display reading is available at the output terminals. When used with a millivolt range, the output voltage may be varied from -9.99 mV to +60.00 mV. The output voltage corresponds directly to the display reading. (Connecting a thermocouple to the terminals in the Output Mode will short out the source voltage defeating the operation of this mode.) Clockwise rotation of the knob increases the reading, while counterclockwise decreases the reading.

Place in the F or C position to both apply power to the Micromite and select Fahrenheit or Celsius scales. The millivolt range operates in either the F or C position. To conserve battery power, turn off the instrument when not is use.

On dual range models, select either Range I or II according to the range table on the rear of the instrument. At time of order, we will indicate on this range table which calibration corresponds to each range. (See Figure 3-1)

A sample range table is reproduced here for convenience and reference.

RANGE TABLE

	RANGE I	RANGE II		RANGE TABLE TOTAL SPAN / OUTPUT SPAN LO	HI
J			F	-320	855	1675
			C	-196	457	913
K			F	-310	1120	2500
			C	-190	604	1371
T			F	-320	750	750
			C	-196	399	399
E			F	-320	665	1650*
			C	-196	352	760*
R			F	30	1770	3200
			C	-1	966	1760
S			F	30	1900	3200
			C	-1	1038	1760
B			F	1000	2780	3200
			C	538	1527	1760
MV				-9.99	25.00	60.00
** P			F	-320	N/A	1500
			C	-196		816

Figure 3-1

3-5 Temperature Measurement

Connect the thermocouple extension leads from the thermocouple to the Micromite terminal posts as outlined in Section 3-1. Make sure the output switch is in the off position. Place the power switch to the F or C position for Fahrenheit or Celsius readings, and select RANGE I or II on dual calibration models corresponding to the thermocouple type being used. Read the thermocouple temperature on the display. Readout is in °F or °C as stated on the display of the instrument.

3-6 Millivolt Measurement (Millivolt Scale Models Only)

Connect the millivolt source to the Micromite terminal posts. Make sure the output switch is in the off position. Place the power switch to F or C. Either position will read millivolts, in the millivolt range. Select Range I or II, whichever corresponds to millivolts. The Micromite will now read the voltage, in millivolts, on the display.

The display will also indicate mV.

3-7 Checking Potentiometer-Type Instruments with Thermocouple Input

To test or calibrate another instrument, connect the Micromite as shown in Figure3-2, using thermocouple extension wire that matches the calibration of the instruments. Place the output switch to the "Lo" or "Hi" position, corresponding to the desired span from the range table on the back of the instrument. Place the power switch to the F or C position for Fahrenheit or Celsius readings. On dual range units, place the range switch to I or II depending on the calibration to be used. Turn the Micromite Output adjust knob until the display indicates the desired temperature. The Micromite and the instrument being tested may be at different temperatures since reference junction compensation functions in this mode.

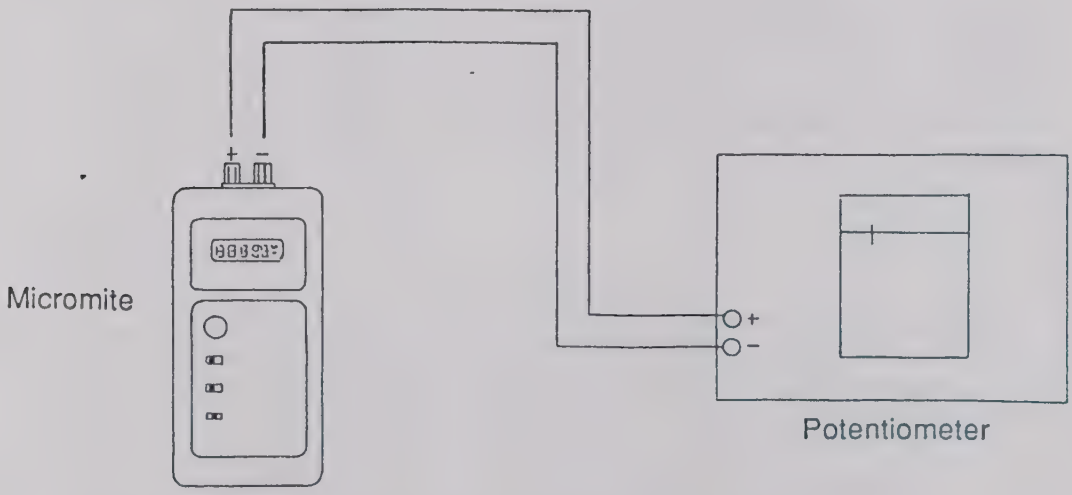


Figure 3-2 Checking Potentiometer Type Instruments With A Micromite

3-8 Checking Potentiometer-Type Instruments with Millivolt Input (Millivolt Scale Models Only)

To test or calibrate another instrument, connect the Micromite as shown in Figure 3-2 using copper lead wires. Place the output switch to the "Lo" or "Hi" position, corresponding to the desired millivolt span from the range table on the back of the instrument. Place the power switch to the F or C position. The millivolt range operates in either position. On dual range units, select Range I or II, corresponding to the millivolt scale on your instrument. Turn the Micromite Output Adjust Knob until the display indicates the desired millivolt value. Be sure the Micromite Indicator/ Calibrator is more accurate than the instrument to be calibrated. It is not necessary to maintain Micromite and the instrument being tested at the same ambient temperature since reference junction compensation functions in this mode.

4-0 THEORY OF OPERATION

The Micromite microprocessor-based digital temperature indicator/ calibrator with internal cold junction reference accepts the millivolt output of a thermocouple and provides a digital display of the equivalent temperature. To accomplish this, it contains the necessary circuitry to convert the input voltage to digital form and to display the result. As the voltage generated by the thermocouple is a nonlinear function of temperature, themicroprocessor circuitry mathematically linearizes the input.

The measuring circuitry of the Micromite is shown in block diagram form in Figure 4-1. The circuitry includes the following elements:

4-1 Analog Digital Converter

The converter will read either the voltage present at the terminals or the reference junction compensator depending on the state of switch S1. The information from the convertor is then fed to the microprocessor and stored as DIGITAL information.

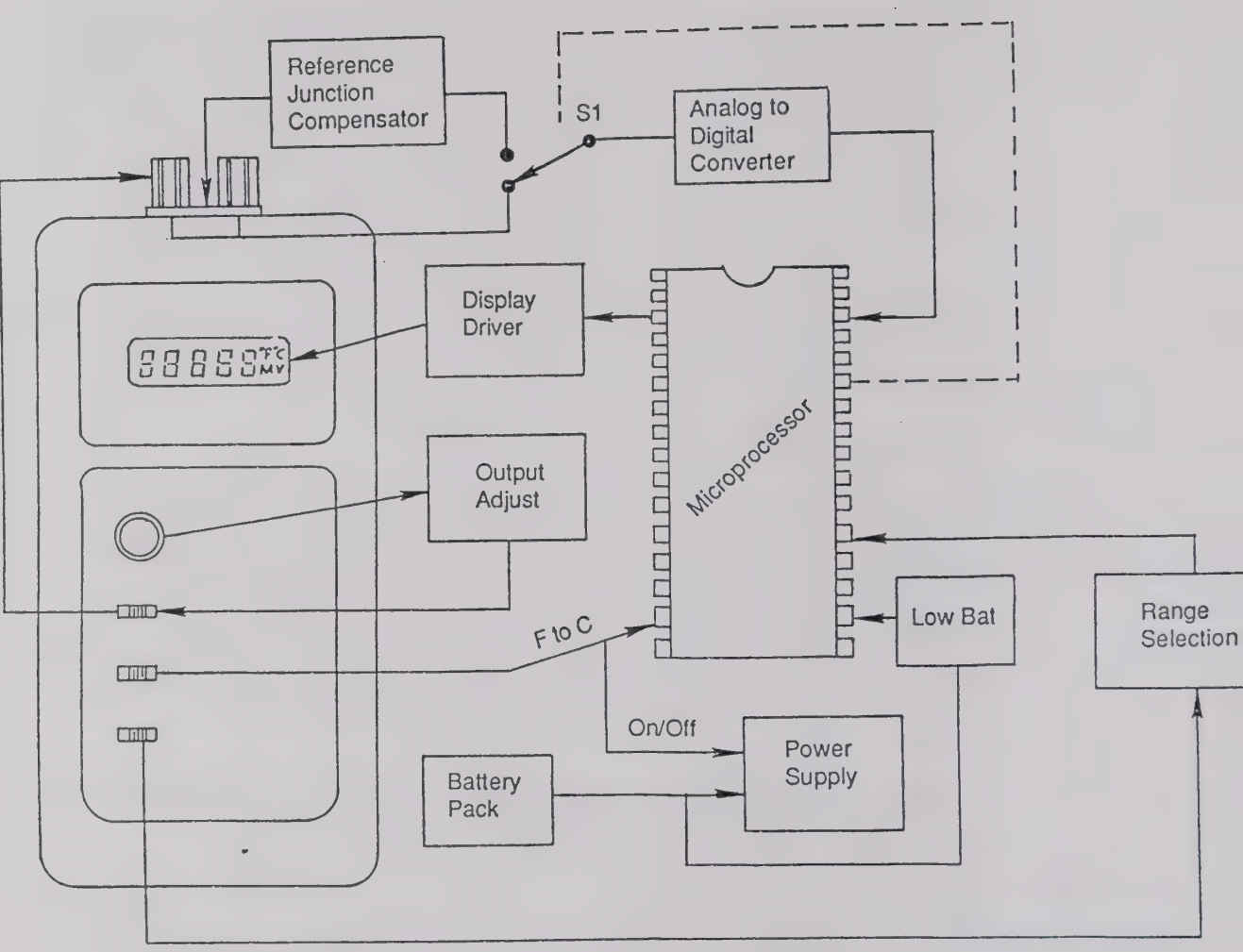


Figure 4-1

Micromite Circuitry Block Diagram

4-2 Reference Junction Compensator

The compensator is a semiconductor temperature dependent current source which is thermally coupled to the input terminals. Its signal is fed to the ANALOG to DIGITAL converter when S1 is in the RJC position, giving a digital value equal to the terminal temperature which is then stored by the microprocessor.

4-3 Display Driver

The display driver receives digital information from the microprocessor and supplies the proper wave forms required to drive the liquid crystal display. The microprocessor provides the 4 or 5 digits required plus the legends °F, °C or mV.

4-4 Range Selection

The range selection circuitry, depending on the position of the range switch, outputs one of two digital codes to the microprocessor thus determining which thermocouple type it will read.

4-5 Output Adjust

The output adjust circuitry receives a signal from the output adjust pot which is then fed to the input terminals of the instrument. The voltage varies from -12 mV to 25 mV on the Low position of the switch and 25 mV to 60 mV on the High position. (For R, S, B calibrations, the values are 4.8 mV to 10 mV to 24 mV respectively.)

4-6 Power Supply

The power supply takes the voltage available from the battery pack and converts it to the different voltages required by the unit.

4-7 Low Battery

The low battery detect circuitry compares the battery voltage against a fixed reference voltage. If the battery voltage drops below 4.6 volts, the circuit signals the microprocessor to indicate "HELP" on the display.

4-8 Battery Pack

Four (4) type 1.2 AHR SC Size Nicad batteries are used to supply power to the unit. A replacement Battery Pack can be ordered. Specify part Number, A9344. A battery pack charger adapter should be used with the battery recharger in order to recharge the battery pack outside the Micromite. Specify Part Number A9381.

4-9 Operation in Indication Mode

A thermocouple signal at the input terminals is converted by the analog to digital converter into a digital number and is passed to the microprocessor. After 4 consecutive conversions upon the input terminals, the microprocessor throws switch S1 to the RJC position and the converter samples the terminal temperature and stores the value in the microprocessor. The microprocessor then converts the RJC temperature into its equivalent millivolt value based on the thermocouple calibration tables stored in memory. This equivalent millivolt value is then added to each of the 4 subsequent readings taken on the input terminals to provide the reference junction compensation. The compensated value is linearized to produce its equivalent temperature based on the calibration which is then displayed on the LCD display. If the "OFF-F-C" switch is set to "C", the program in the microprocessor converts its Fahrenheit temperature values to Centigrade and displays them.

4-10 Operation in the Calibration Mode

In the calibration mode, a millivolt source with a 50 ohm output impedance is switched across the input terminals, and the instrument will read the temperature corresponding to the millivolt value at the terminals. The output pot's span of -12 mV to 60 mV (-4.8 mV to 24 mV for R, S, B calibrations) is split in half to allow better resolution on the output adjusting potentiometer.

5-0 TROUBLESHOOTING

5-1 General

Before attempting troubleshooting procedures, check to see:

A. Unit is charged.

B. Sensing element is in tact and functioning properly.

5-2 Disassembling the Case

Remove the four (4) screws located in the corners at the rear of the case.

Note: Screws will remain in the case. Do not try to pull screws all the way out.

Disconnect battery pack. Remove adjustment potentiometer knob located on the front panel. Carefully remove electronics from front half of case without distrubing P.C. board interconnect straps (found on earlier models) or header connectors.

At this point, visually inspect both boards for any broken or burnt components, loose IC's or broken wires and check P.C. board interconnects for broken or burnt pins. Reconnect battery pack and continue to appropriate troubleshooting procedure.

5-3 Trouble Shooting Guide

	POSSIBLE CAUSES	
SYMOPTOMS	A9170 BOARD	A9168 BOARD
Unit fails to charge		Battery pack defective Battery pack wires broken Charger defective Charger jack shorted SWR switch "On-F-C" defective
Unit fails to initialize	Check ±7.5V power supply IC8, IC9,C16,C15,IC10 (Resistor pack) R1, IC9, CR2, CR3, CR4, C7, C5, T1 Check converter: IC4, IC5, Q1,Q2, CR1, CR2, IC6, IC3, CR3, IC7	(If dual range check) SW3 range switch Check power supply following parts: R1, IC9, CR2, CR3, CR4, C7, C5, T1 Check range circuit XX1, XX2 (range modules) IC6, IC7 Check clock circuit: Q2, IC10, CRY1 Check reset circuit: Q3, Q4, C10, CR6 Check microprocessor: IC2

POSSIBLE CAUSES

SYMOPTOMS	A9170 BOARD	A9168 BOARD
Unit fails to read proper input (check sensor connections)	Check converter: ICl, IC2, CR3, IC3, IC6,IC7, IC9, IC4, IC5, IC8, IC11 (resistor pack) C1, C2, Q1, Q2 Check RJC: Q3, R1, R13, R14, R15, C13	Check power circuit: SW3, XX1, XX2, Check display circuit: IC1, IC3, IC4, IC5 Check microprocessor: IC2
Unit fails to output properly (thermocouple sensor should not be connected while outputting)	Check gain select: IC6, R33, R32 Check ±7.5 IC8, IC9, C16, C15, IC10, (resistor pack)	Check output circuit: R17, SW1, IC8, R18, R12, R16, R5, R6
I Display A. Shows invalid Characters (i.e. shadows or missing segments) B. Shows alpha numeric characters		Check LCD display Check display circuit: IC5, IC4, IC3, IC1 Microprocessor: IC2 Check range circuit: XX1, XX2, IC6, IC7, SW3
Noisy Readings	Check converter: IC1, IC2, IC4, IC5, IC7, Q1, Q2, IC3, IC6, CR1, CR2	

6-0 CALIBRATION AND TESTING

6 - 1 Equipment Required

1. Precision adjustable voltage standard ± 100 mV, .005% accuracy, .001 mV resolution.
2. Ice Point Reference 32°F air saturated ice bath; Rosemont model 911 A.
3. J type thermocouple ice leads with calibrated error at 75°F NBS traceable; TE Part Number A9394-2.
4. Test switch assembly; TE Part Number A95l9.
5. 1/16" allen wrench.

6-2 Visual Inspection

1. Check all capacitors, diodes and integrated circuits for proper polarity.

2. Check that all wave soldered component leads are fully inserted and soldered into circuit board.

3. Check for solder bridging between adjacent laminations or solder pads.

6-3 Preliminary Check

1. Turn on "OFF", "F", "C" switch. Unit should display "00000" for a few seconds and then display "HI". Short out the units input terminals and unit should display approximate room temperature. (mV unit should read ".00mV").

2. If unit passes above checks, proceed with calibration.

6-4 Calibration Set Up

1. Place Micromite face down on a table with instruction label facing up. Leave the bench stand closed and screwed down.

2. Loosen and back out completely the four (4) corner screws on the two halves of the case. These screws are captive.

3. Carefully separate the two case halves and place the back half flat on the table.

4. Remove battery from battery holder on back of case.

5. Using a 1/16" allen wrench, loosen the two (2) set screws on the output adjust knob and remove the knob from the unit.

6. Apply downward pressure on the shaft of the output adjust potentiometer to pop out the circuit board assembly.

7. Carefully remove the circuit boards from the case exercising care not to strain battery pack wires..

8. Locate IC6 (See Figure 6-2) and remove. (Device static sensitive).

9. Plug connector on switch box cable into socket XIC11 (See Figure 6-1) on top P.C. board (A9168). Be sure to observe proper pin 1 location.

10. Plug in battery charger. Switch on, "OFF", "F", "C" switch to "F" and allow unit to warm up to 20 minutes.

A. Zero and Span Calibration

1. Connect the unit as per diagram in Figure 6-3.

2. Plug the remaining side of dip header into test switch assembly observing proper polarity.

3. Set mV source to 0.000 mV.

4. Turn on (up) SW4 and SW5 on test switch assembly.

5. Locate R8 (Figure 6-5) and adjust it until display on unit reads 25550.

6. Turn off (down) SW4 and SW5 on test switch assembly.

7. Turn on (up) SW3 on test switch assembly.

8. Locate R2 (Figure 6-5) and adjust it until display on unit reads .000 mV. (If display is noisy, center around calibration point).

9. Set mV source to 84.000 mV.

10. Locate R18 (figure 5) and adjust until display reads 84.000 mV. (Center if noisy).

11. Set mV source to 28.000 mV.

12. Turn on (up) SW2.

13. Locate R17 (Figure 6-5) and adjust until display reads 84.000 mV. (Center if noisy).

14. Turn off (down) SW1, SW2, SW3.

B. Reference Junction Compensation Calibration

1. Prepare Ice Bath and connect mV source, ice bath reference couple and unit as shown in Figure 6-4. Allow all connection 10 minutes to stabilize. (For maximum accuracy area should not have drafts and units terminals should be wrapped with foam rubber or other insulation).

2. Make sure the "OFF", "F", "C" switch is in the "F" position.

3. Turn on (up) SW6.

4. Examine the calibration tag on the reference thermocouple. This should contain the value of the error in mV at 75°F.

5. Adjust the mV source to output the negative of the error.

   Example: Error = .005 mV — mV source = .005 mV
   Error = .004 mV — mV source = .004 mV

6. Locate R14 (Figure 6-5) and adjust until display reads 32°F.

5. Adjust the mV source to output the negative of the error.

   Example: Error = .005 mV — mV source = .005 mV
   Error = .004 mV — mV source = .004 mV

6. Locate R14 (Figure 6-5) and adjust until display reads 32°F.

C. Reassembly

1. Turn off "OFF", "F", "C" switch and disconnect all wires from unit. Remove elastic bands from calibration case and separate case halves.

2. Unplug 8 pin dip header from socket XIC11 and disconnect battery charger.

3. Reinsert IC6 into socket making sure pin 1 is properly oriented. (Antistatic precautions should be observed).

4. Insert P.C. board assembly into top half of case making sure that it is properly seated and no wires are caught between board and case.

5. Mate the larger of the two bottom sections of the case with the top half and screw down the two retaining screws.

6. Snap the battery into the battery holder on the smaller section of the bottom of the case.

7. Place battery charger jack in the recess in the case. Make sure to dress the wires properly.

8. Close up the unit and screw down the remaining two screws. (Make sure no wires are caught in the case halves)!

9. Turn on "OFF"< "F"< "C" switch. Unit should display "00000" for a few seconds and then display "HI". Short out the units input terminals and unit should display approximate room temperature. (mV unit should read ".00 mV").

6-5 DISPLAY 7 LOGIC MICRO P/C BD. ASS'Y
P/N A9168

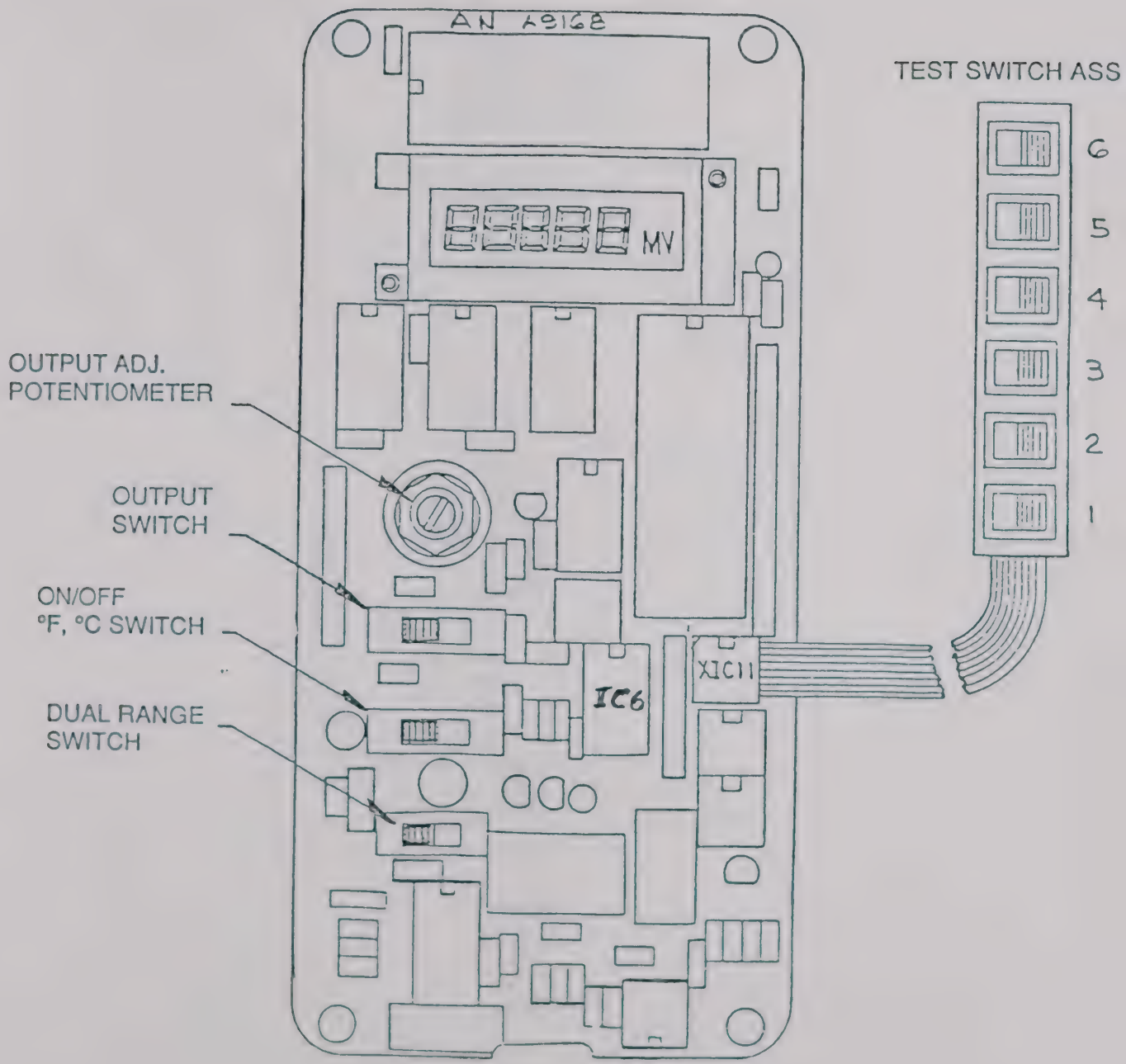


Figure 6-1

6-6 A to D CONVERTER P/C PD. ASS'Y
P/N A9170

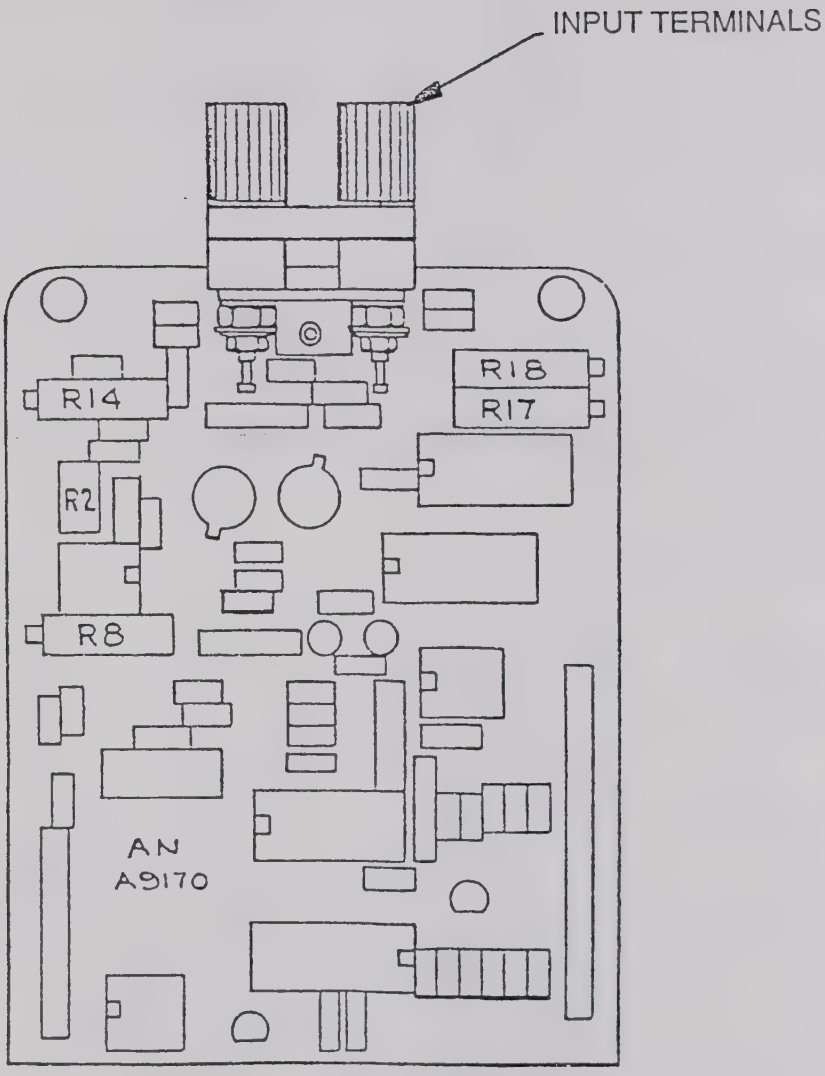


Figure 6-2

6-7 ZERO AND SPAN CALIBRATION DIAGRAM

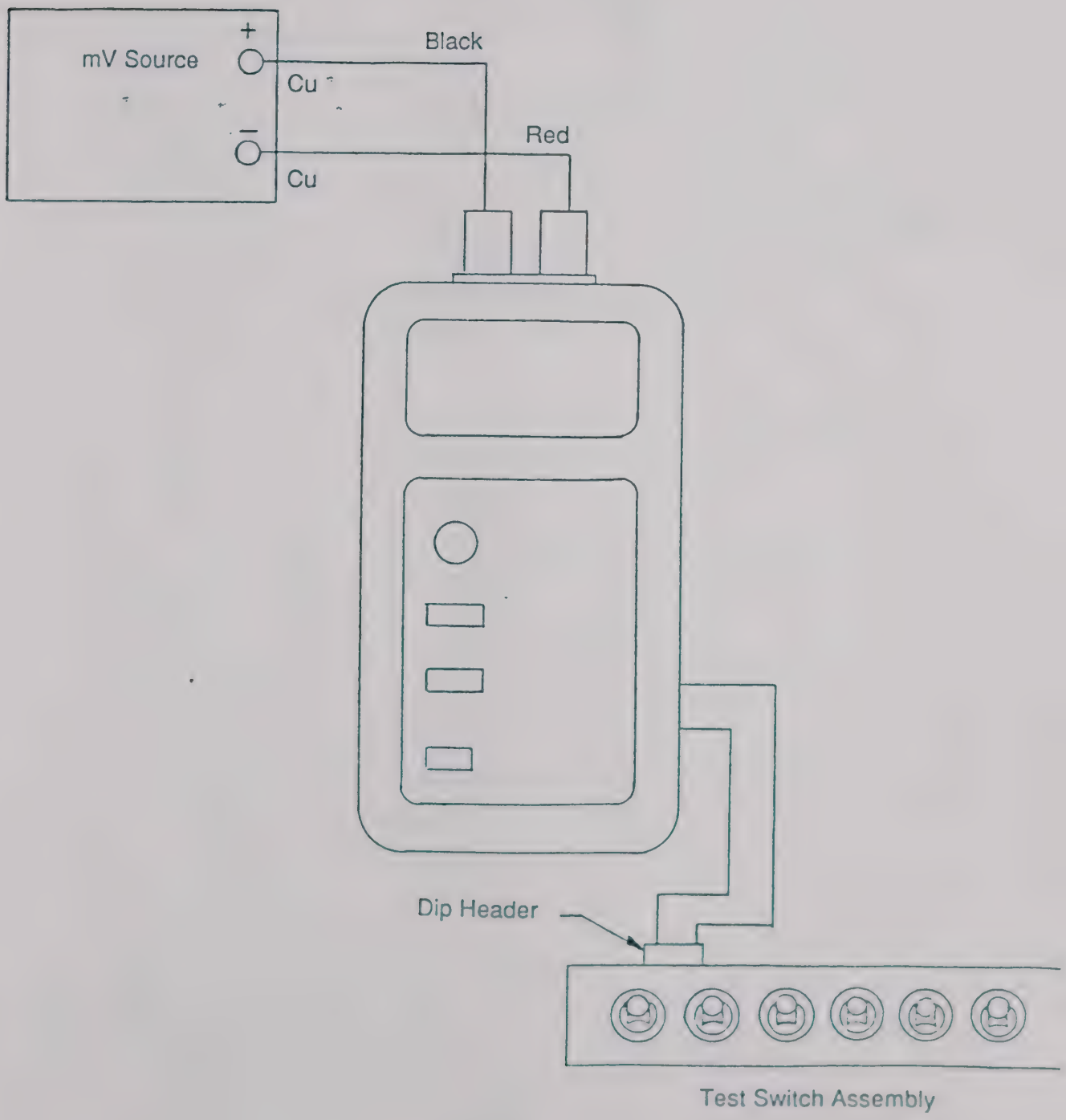


Figure 6-3

6-8 REFERENCE JUNCTION HOOKUP DIAGRAM

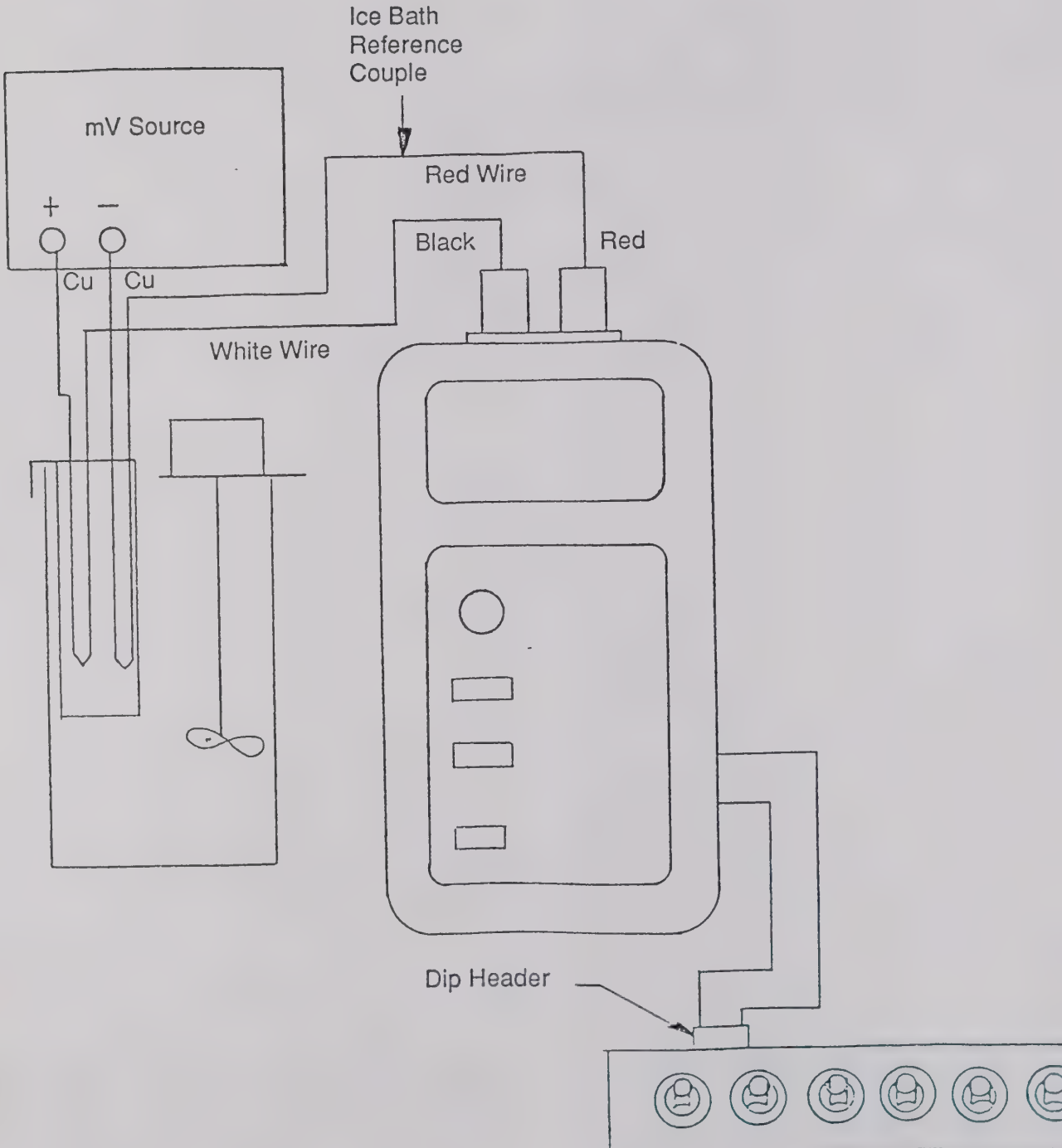


Figure 6-4

6-9 CALIBRATION POTENTIOMETERS ADJUSTMENT DIAGRAM

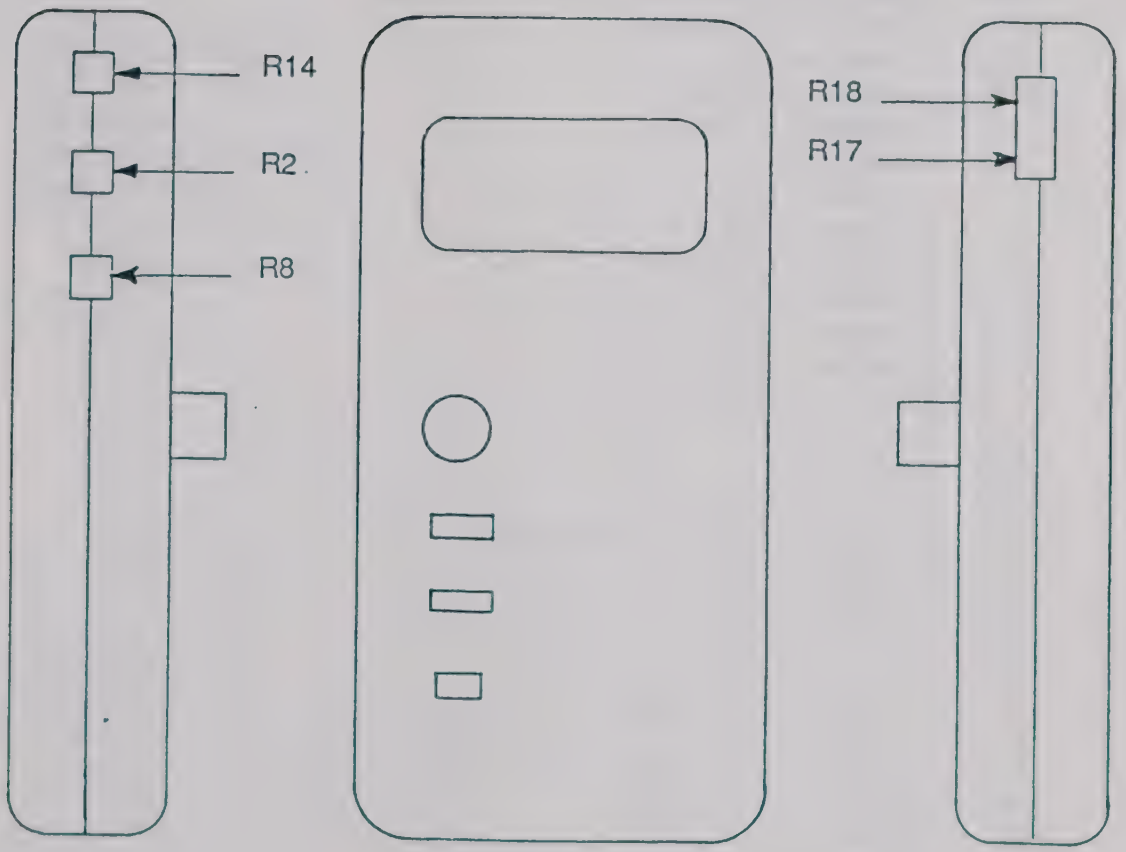


Figure 6-5

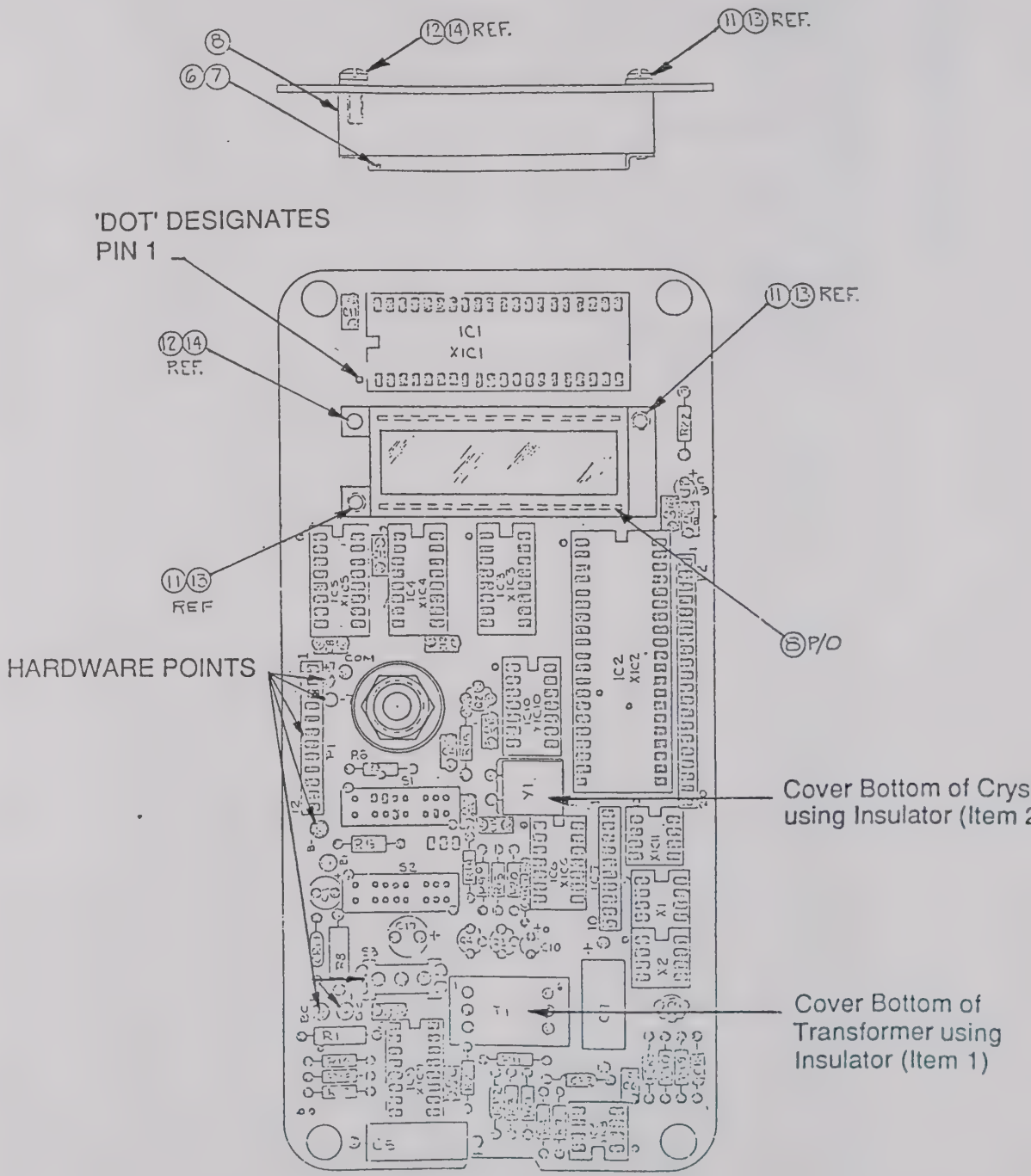
7-0 SECTION 7 - PARTS LIST

DISPLAY 7 LOGIC MICROPROCESSOR P/C BOARD ASSEMBLY

PART NUMBER A9168

No.	Description	TE Part No.
PCB1	Display & Logic Microprocessor P/C Board	A9167
C1	Capacitor - 100µf, 10V	A8890
C2	Capacitor - .1µf	A8274-9
C3	Capacitor - .0047µf	A8274-7
C6	Capacitor - .015µf	A8274-6
C4	Capacitor - 47pf	A8274-11
C18	Capacitor - 33pf	A8274-10
C5	Capacitor - 47µf, 25V	A9230-1
C7	Capacitor - 100µf, 25V	A9230-2
C17	Capacitor - 220µf, 6.3V	A9280-3
C10	Capacitor - 4.7µf, 25V	A9280-1
C15	Capacitor - 2200pf	A8710-4
C16	Capacitor - 220pf	A8710-3
CR1	Diode - IN4001	A5005
CR2	Diode - IN914	A6789
CR4	Diode - IN4745	A9045-2
R1	Resistor - .47ohms 1/2w wire wound	A9221-2
R2	Resistor - 200ohms	A5719-132
R3	Resistor - 10K 1%	A8688-15
R4	Resistor - 100K 1%	A8688-26
R5	Resistor - 2.37K 1%	A8688-65
R6	Resistor - 50ohms 1%	A8688-70
R7	Resistor - 20K 1%	A8688-19
R11	Resistor - 20.5K ohms	A8688-82
R8	Resistor - 10ohms 1/2w	A7241-46
R9	Resistor - 10K	A5719-102
R10	Resistor - 22K	A5719-51
R12	Resistor - 516K 1%	A8688-66
R14	Resistor - 100K	A5719-88
R15	Resistor - 2.2K	A5719-119
R16	Resistor - 110K 1%	A8688-55
R18	Resistor - 195K 1%	A8688-69
R20	Resistor -620K	A5719-128
R21	Resistor - 33.3K 1%	A8688-67
R22	Resistor - 820ohms	A5719-10
XIC1	Socket - 40 pin	A9241
XIC3	Socket - 16 pin	A7289
XIC6	Socket - 14 pin	A7288
XX1	Socket - 8 pin	A6724

IC1	ICM 7211 AIPL	A9175
IC2	6500/1	A9174
IC3	CD4056BE	A9176
IC4	CD4054BE	A9177
IC5	CD4028BE	A9178
IC6	CD4011BE	A9239
IC7	Resistor Sip Network	A9233
IC8	LM358	A8960
IC9	UA78540PC	A9236
IC10	74LS93N	A9180
Q1	Transistor - 2N3904	A8590
S1	Slide Switch 4P/3T	A9240
T1	Transformer	A9161
Y1	Crystal - 3.93216 MHZ	A9182
I	Insulator, .687 Dia	A9345-1



P/N A9168 P/C BOARD LAYOUT DRAWING

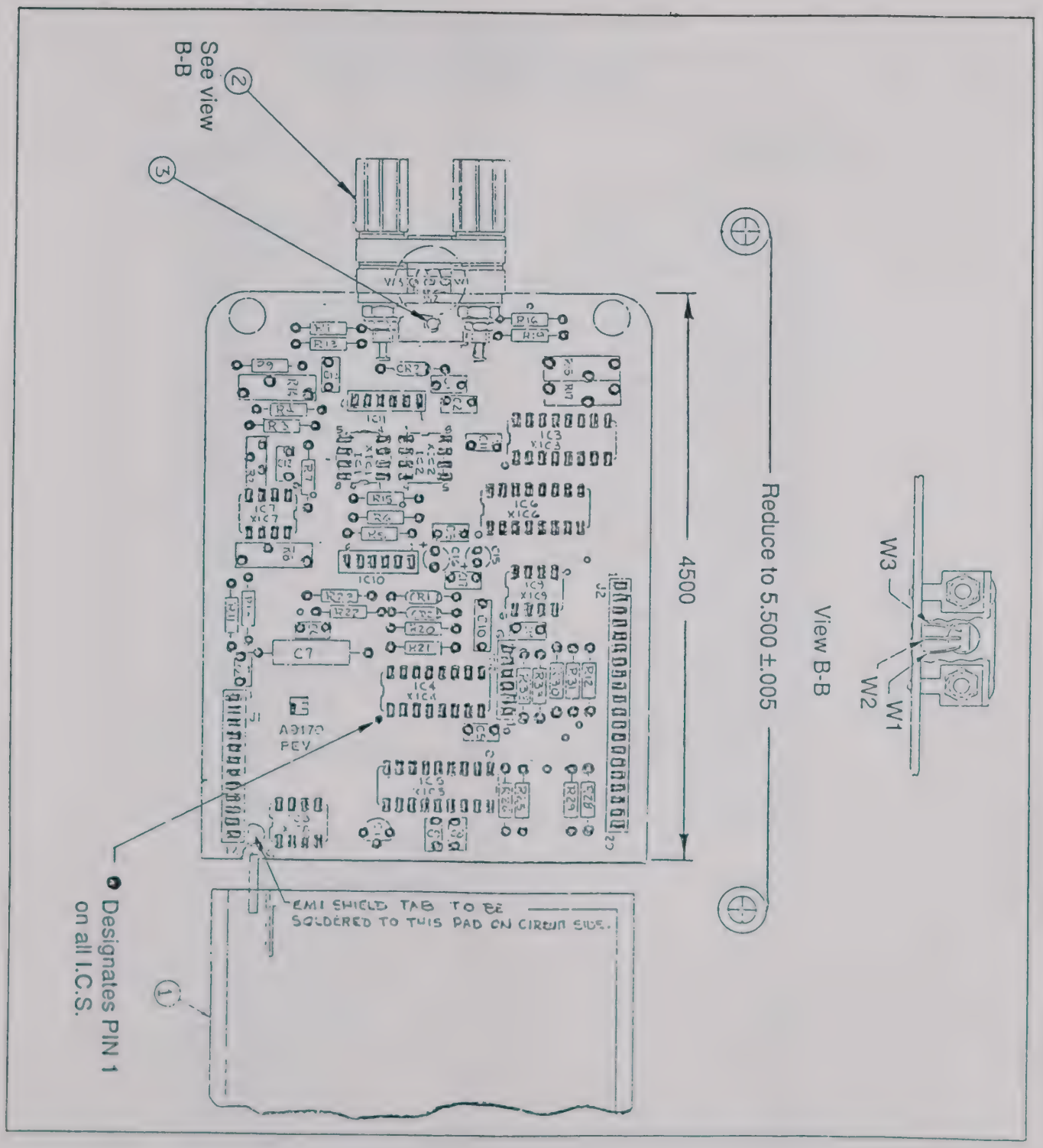
SECTION 7 - PARTS LIST

ANALOG TO DIGITAL CONVERTER P/C BOARD ASSEMBLY

PART NUMBER A9170

No.	Description	TE Part No.
PCB1	Analog to Digital Converter P/C Board	A9169
C1	Capacitor - .47µf	A8274-2
C3	Capacitor - .1µf	A8274-9
C7	Capacitor - .47µf, 100V	A9229
C10	Capacitor - 1000pf	A9227
C12	Capacitor - .015µf	A8274-6
C11	Capacitor - 33pf	A8274-10
C15	Capacitor - 22µf, 16V	A9285
CR1	Diode - IN914	A6789
R1	Resistor - 62056, 1%	A9232
R2	Potentiometer - 100K (1 turn)	A8163-9
R3	Resistor - 7 50K, 1%	A8688-61
R4	Resistor - 2ohms, 1%	A8688-72
R5	Resistor - 10K	A5719-102
R7	Resistors - 110K, 1%	A8688-55
R8	Potentiometers - 5K (20 turn)	A6245-6
R9	Resistor - 1.96K, 1%	A8688-87
R10	Resistor - 18.7K, 1%	A8688-73
R11	Resistor - 71.5K, 1%	A8688-74
R12	Resistor - 22K	A5719-51
R13	Resistor - 17.4K, 1%	A8688-86
R16	Resistor - 320K, 1%	A8688-75
R14	Potentiometer - 2K (20 turn)	A6245-4
R17	Potentiometer - 10K (20 turn)	A6245-3
R19	Resistor - 105K, 1%	A8688-76
R20	Resistor - 47K, 1%	A8688-79
R21	Resistor - 4.7K, 1%	A8688-80
R24	Resistor - 4.7K	A5719-116
R25	Resistor - 3.3K	A5719-123
R26	Resistor - 6.8K	A5719-19
R28	Resistor - 27ohms	A5719-131
R32	Resistor - 25K, 1%	A8688-86
R33	Resistor - 10K, 1%	A8688-15
XIC3	Socket - 16 pin	A7289
XIC5	Socket - 18 pin	A9242
XIC7	Socket - 8 pin	A6724
IC1	U426	A9183
IC2	AD542JM	A9184
IC3	CD4053BE	A9185
IC4	LD120	A9186
IC5	LD121A	A9187
IC7	TL061CP	A9237

IC8	Ref - 02HP	A9188
IC9	LM358	A8960
IC10	Resistor Sip Network	A9214-1
IC11	Resistor Sip Network	A9214-2
IC12	Resistor Sip Network	A9214-3
Q1	Transistor - 2N3904	A8590
Q2	Transistor - 2N3906	A8591
J1	IC Socket, 12 pin	A9399-1
J2	IC Socket, 20 pin	A9399-2



P/N A9179 P/C BD. LAYOUT DRAWING

P.C. BOARDS STOCK UNIT ASSEMBLY

PART NUMBER 3115-000000

Description	TE Part No.
A/D Converter P.C. Bd.	A9170
Shield - EMI	A9269
Input Terminal Assembly	A9254
Screw #4 - 40X 3/16 Lg. Bind. Hd.	B5052-8
Display & Logic P.C. Bd.	A9168
"R17" 50K Potentiometer	A9234
Washer, Insulating (for R17)	A6075
I/O Header Connector, 20 PIN A9400-2	A9464-2
Liquid Crystal Display	A9173
Bezel, LCD P.C. Mtg.	A9268
Connector, LCD	A9250
Screw #4 - 40X 5/8 Lg. Bind. Hd.	B5052-4
Washer, #4 Insulating Nylon	A4538
Screw #6 - 32X 3/8 Lg. Bind. Hd.	6800-2
Washer #6 Insulating, Nylon	A9282
Tab, 110 Series	A9275
Jack, Battery Charger	A8610
Receptacle, 110 Series	A8367
Battery Assembly	A9344
Standoff, Nylon, Both Ends Split	A9216
Bushing, Charger Jack	A8835
Insulator, .937 DIA	A9345-2
Pod Post Insulation	A8366
Shrink Tubing 1/8" ID	A9211-1
I/O Header Connector, 12 pin	A9464-1

SECTION 8
RECOMMENDED MICROMITE SPARE PARTS

DISPLAY AND LOGIC MICROMITE P/C BOARD ASSEMBLY NO. A9168

No.	Description	TE Part No.
S1	4P/3T Slide Switch	A9240
S2	4P/3T Slide Switch	A9240
S3	SPDT Slide Switch	A9340
T1	Inverter Transformer	A9161
Y1	Crystal - 3.93216MHZ	A9182
IC1	ICM 7211AIPL - Intersil	A9175
IC2	Microprocessor	A9174
IC3	CD4056BE - RCA	A9176
IC4	CD4054BE - RCA	A9177
IC5	CD4028BE - RCA	A9178
IC6	CD4011BE - RCA	A9239
IC7	Resistor Pack	A9233
IC8	LM358 - N.P.S.	A8960
IC9	UA78S40PC - Fairchild	A9236
IC10	74LS93N - N.S.	A9180
R1	.47 ohms WW Resistor	A9221-2
BAT	Battery Assembly	A9344
R17	50K 10 turn Potentiometer	A9234
LCD	Liquid Crystal Display	A9173
LCDCon	Connector, LCD	A9250

ANALOG TO DIGITAL CONVERTER P/C BOARD ASSEMBLY NO. A9170

No.	Description	TE Part No.
IC1	U426 - Siliconix	A9183
IC2	AD542JM - Analog Devices	A9184
IC3	CD4053BE - RCA	A9185
IC4	LD120 - Siliconix	A9186
IC5	LD121A - Siliconix	A9187
IC7	TL0C1 CP - T.I.	A9237
IC8	Ref - 02 HP - PMI	A9188
IC9	LM358 - NS	A8960
IC10	Resistor Pack	A9214-1
IC11	Resistor Pack	A9214-2
IC12	Resistor Pack	A9214-3
Shield	EMI Shield	A9269
RJC	RJC and Input Terminals	A9238

UNIT ASSEMBLY SPARE PARTS

No.	Description	TE Part No.
1	PC Boards Stock Unit Ass'y	3115000000
2	Case Ass'y	A9348
3	Slide Switch	A9340
4	Dress Panel	A9260-
5	Carrying Strap	A9318
6	Instruction Label	A9272
7	Display Window	A9262
8	Knob	A9279
9	Battery	A9257
10	Range Module	A9346-1

MICROMITE OPTIONAL ACCESSORIES

Description	TE Part No.
230 VAC Battery Charger	A9380
External Battery Pack Charger Adapter	A9381

9-0 OPERATING THE MICROMITE WITH RTD MODULES

9-1 RTD Input Module

9-1-1 General Description

This device is used only with a Micromite having a "P" range II. It accepts the input of 3 or 4 wire 100 ohm 0°C Platinum RTD's having an Alpha of 0.00385 ohms/ohm/°C. (DIN 43760 Curve). It can be used to indicate temperature only. In the output mode the Micromite with a "P" Range II outputs a -10 to 60 mV reference signal to calibrate instruments with an accuracy of +/-0.1mV over the entire 70 mV span.

9-1-2 Operation

To use Micromite with the RTD module to read the temperature of 3 or 4 wire 100 ohm Platinum RTD's having an Alpha of 0.00385 ohms/ohm/°C, plug the RTD module into the Micromite terminals observing polarity. A slide switch on the front indicates 3 or 4 wire form. The RTD is hooked up to the binding posts of the RTD module and the RTD module is switched on. To check the battery, move the On/Off slide switch to the right. An LED will illuminate if the replaceable batteries are functional. The Micromite should be in the indicate, not calibrate mode.

9-1-3 Specifications

Input Circuit: Excitation circuit via precision current source
Excitation Current: 100 uA
Battery Life: 600 hours continuous
Batteries: Three AAA standard batteries
Conformity: .2°F(.1°C)
Accuracy: +/-.7°F(+/-.4°C)
Drift: .02 deg/deg
Range: -320 to 1500°F(-195 to 815°C)
Storage Temperature: -20 to 60°C with batteries. If battery has been subjected to temperature colder than 0°C, the unit should be allowed to warm up to operating range.
Operating Temperature: 0°C to 55°C.

9-1-4 Description Code

The order code of the Micromite RTD Input Module is: E1868.

9-1-5 Battery Replacement

To change or replace a dead battery, remove the RTD module from the Micromite. Remove the 2 screws on either side of the unit and unsnap the 2 halves of the case apart. Remove the batteries and replace with equivalent AAA types. Reassemble.

9-2 RTD OUTPUT MODULE

9-2-1 General Description

The RTD output module is used in conjunction with Micromite having a "P" range and the RTD input module. It is used to simulate the resistance signal of RTD's to calibrate RTD input instrumentation.

9-2-2 Operation

To simulate the resistance signal of 3 or 4 wire 100 ohm @ 0°C platinum RTD's to DIN Curve 43760 (Alpha of 0.00385 ohms/ohm/°C), utilize the following procedure. Plug the RTD input module into the Micromite input terminals observing polarity. A slide switch on the front of the input module indicates 3 or 4 wire operation and should be positioned to the proper lead wire form. Position the range switch of the Micromite to the "P" range II. Be sure the Micromite is in the indicate NOT output mode. Plug the RTD output module into the RTD input module. Place the RTD input module to the ON position. Hook up the leads for the instrument to be calibrated in either the 3 or 4 wire form. Position the rocker switch on the RTD output module in the "To Micromite" position. Using the coarse and fine potentiometers on the RTD output module dial the temperature resistance equivalent you wish to output on Micromite display. Depress the rocker switch on the output module in the "To Instrument" position. At this point Micromite display will indicate "Hi", and the resistance signal will be transmitted to the instrument being calibrated. To check the temperature signal reposition the rocker switch to the "To Micromite" position. The temperature being output will appear on Micromite display.

9-2-3 Description Code

The order code of the Micromite RTD output module is E1373

WARRANTY

Thermo Electric Co., Inc. warrants Micromite to be free from all defects in material and workmanship for a period of two years, commencing on the date of shipment from Thermo Electric or one of our approved distributors.

The liability of the seller is limited to the repair or the replacement of the product only if failure occurs during the warranty period and factory inspection shows no external affects or customer repair altered the functioning of the instrument.

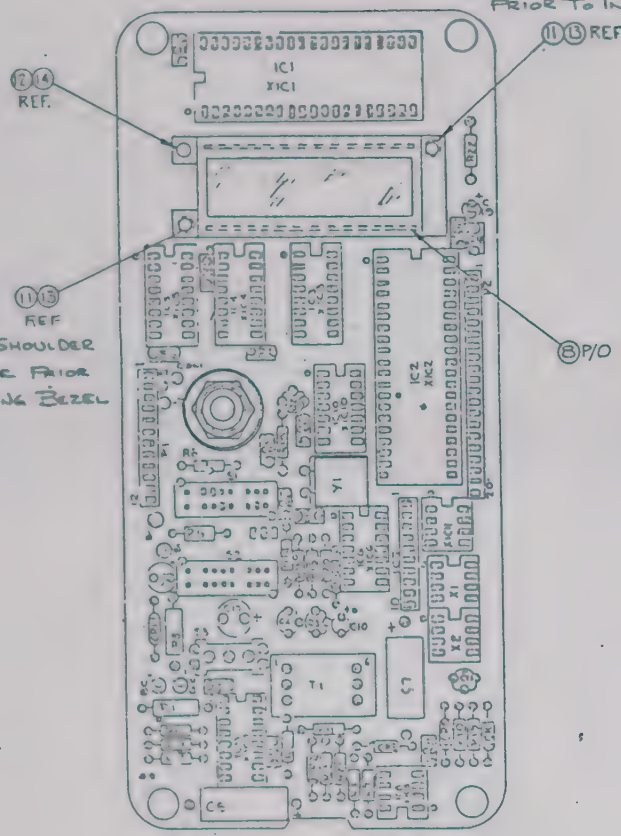
The instrument is to be returned to Thermo Electric or the nearest Thermo Electric authorized service center, freight prepaid, via the most economical service transportation methods after authorization by Thermo Electric. All charges for handling, reinstalling and miscellaneous expenses incurred will be the responsibility of the buyer. When factory examination shows the returned instrument to be within the above warranty period, the equipment will be repaired or replaced, at the seller's option at no charge to the buyer. This warranty shall be rendered null and void when, in the judgement of qualified Thermo Electric personnel, the equipment has been subject to abnormal or abusive use or lack of proper care of maintenance by the buyer, or when it has been determined that environmental conditions have exceeded those specified by Thermo Electric.

Any alteration or repair of the goods by the buyer or any party not authorized by Thermo Electric without our specific consent in writing, shall automatically terminate our warranty oblication.

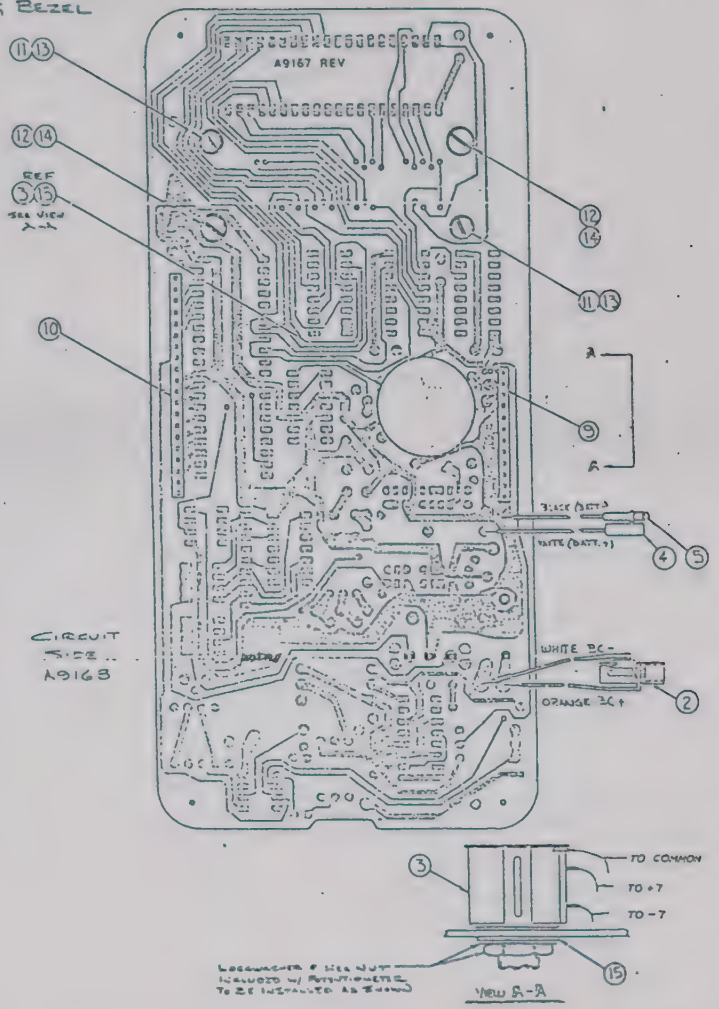
This warranty on instruments manufactured and/or sold by Thermo Electric, or on any service provided by us, is expressly in lieu of all other warranties, expressed or implied. No warranty is made of MERCHANTABILITY or fitness for any particular purpose.

No agent is authorized to assume any liability for it or to make any written or oral warranties or obligations beyond those set forth herein unless endorsed in writing and signed by an officer of Thermo Electric.

TRIM OFF SHOULDER OF CONNECTOR PRIOR TO INSTALLING BEZEL



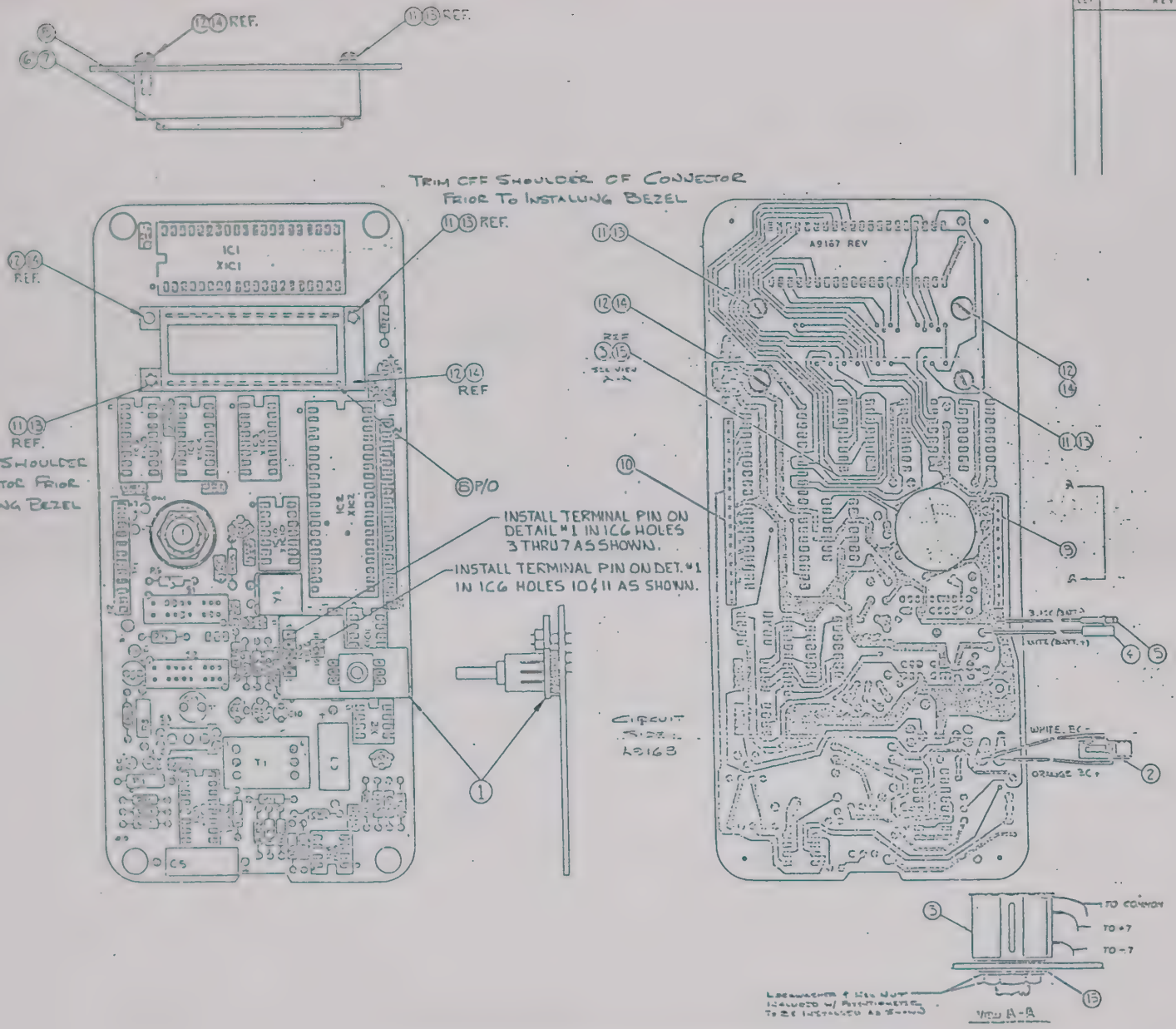
TRIM OFF SHOULDER OF CONNECTOR PRIOR TO INSTALLING BEZEL



CIRCUIT SIDE A9168

FOR COMPLETE LIST OF MATLS SEE ML A9168-□

Next Assy:	Scale	Dwg Made & Approved By	Checker	Engineer	DISPLAY & LOGIC MICRO. P.C. BD. ASSY.
Material	Tolerances (unless otherwise noted) Decimals .x = ± .015 .xx = ± .010 .xxx = ± .005 Fractional = 1/64 Break corners and edges .010 max All dimensions in inches unless otherwise specified	Initial			
		Date			
	THERMO ELECTRIC Saddle Brook, New Jersey 07662				A9168-1 SHT 1 OF 2 Rev. N



LET	REVISION	DATE	CHK'R	ENGR

FOR COMPLETE LIST OF MATLS. SEE MLA9168-D

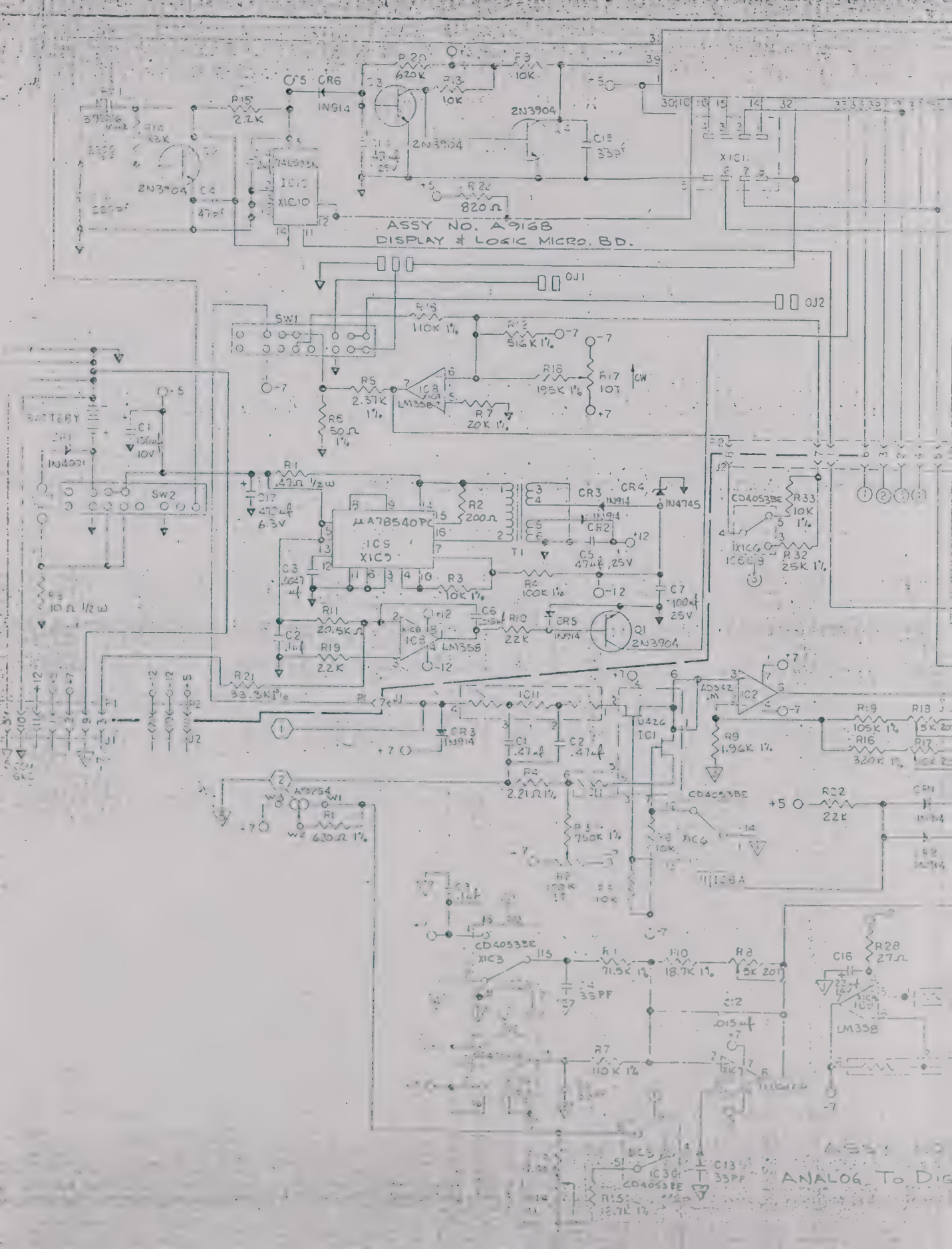
Next Assy	Size	Dwg Master	Drafter	Checker	Engineer
Material	Tolerances (unless otherwise noted)	Approved By			
	Decimals .x ± .015 .xx ± .010 .xxx ± .005	Model			
	Fractional ± 1/64	Date			
	Break corners and edges .010 max				
	All dimensions in inches unless otherwise specified				

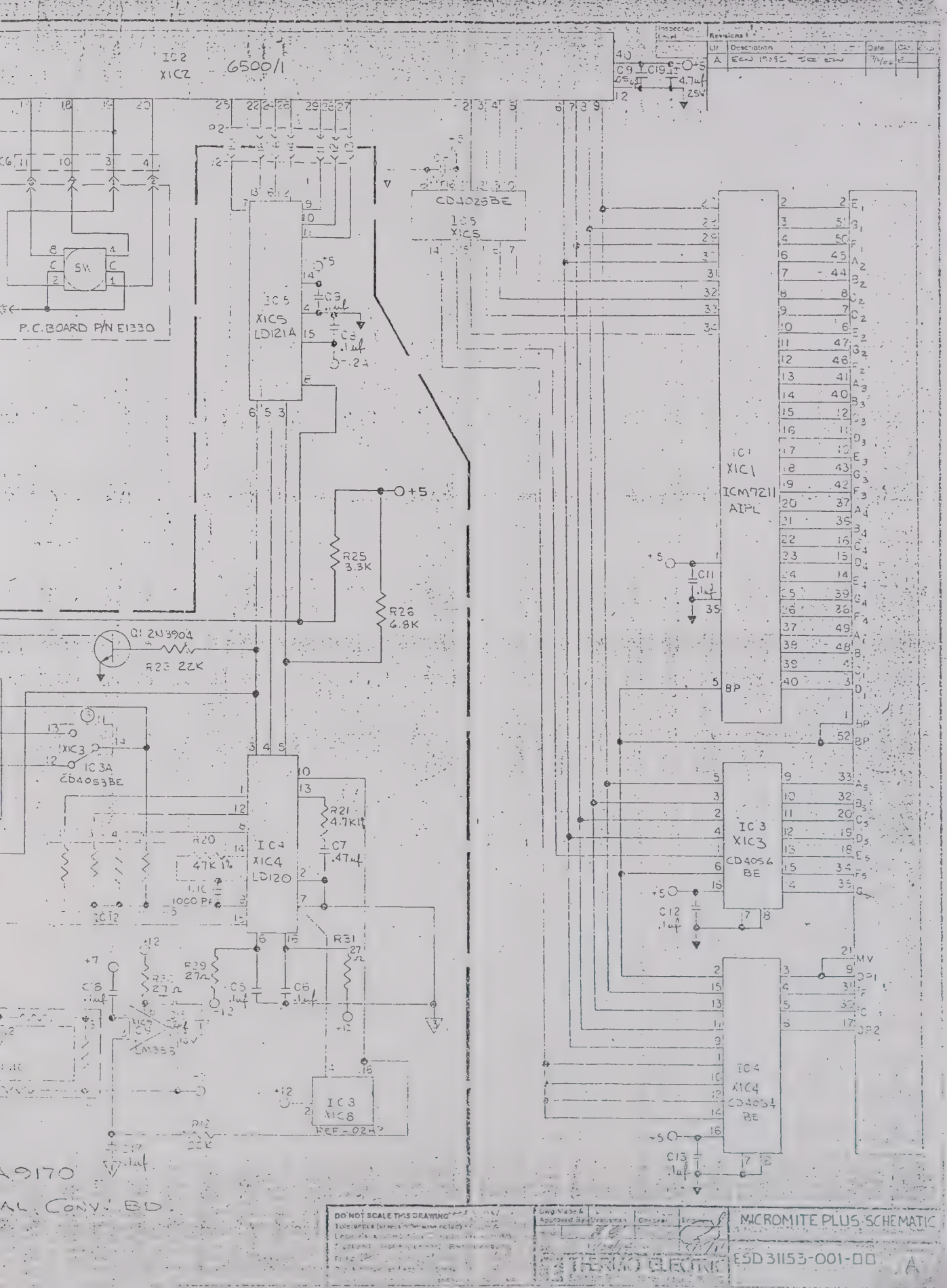
DISPLAY & LOGIC MICRO. P.C.BD. 455Y.

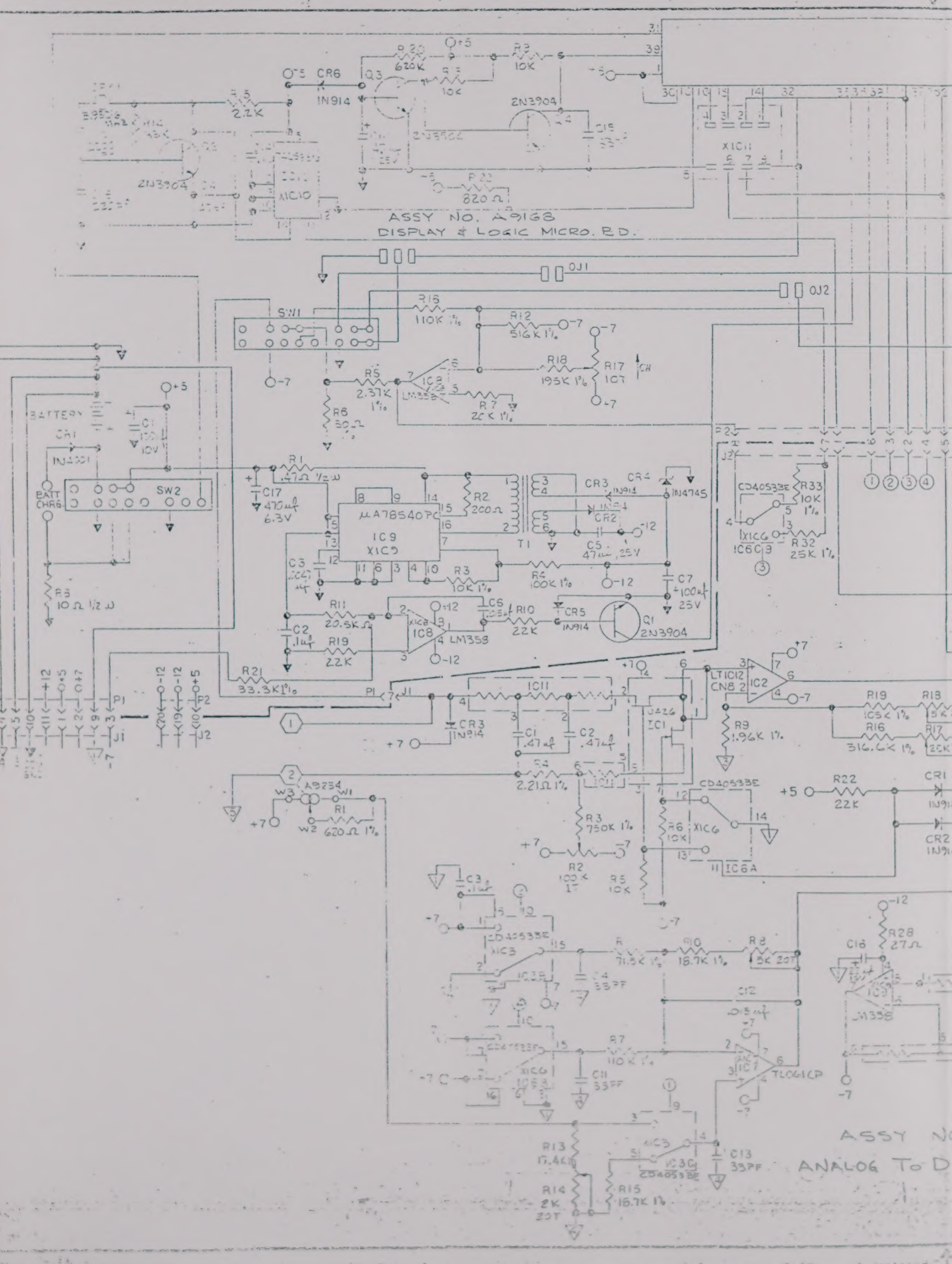
A9168-2

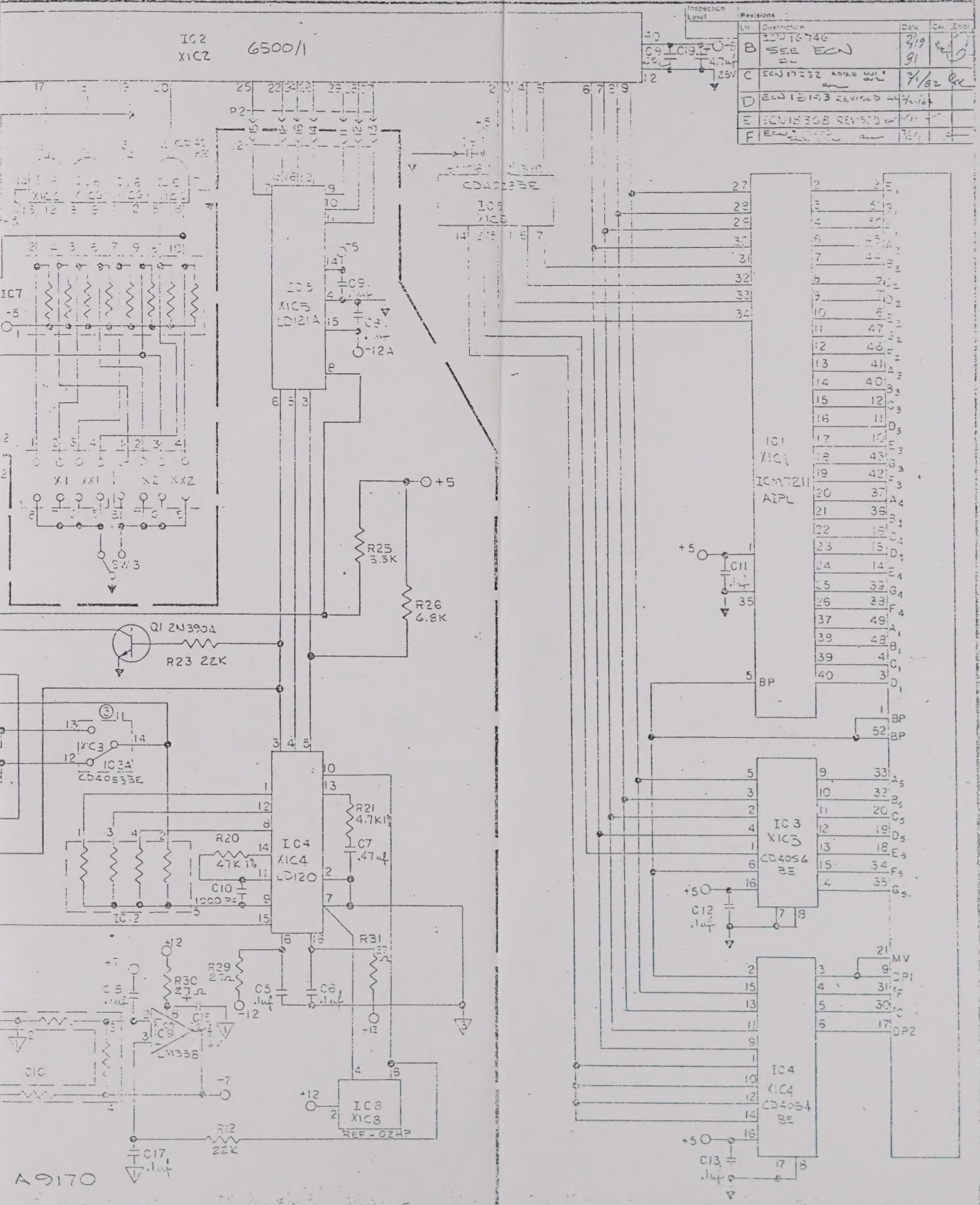
SHT 2 OF 2

REV N


ASSY NO. A9168
DISPLAY & LOGIC MICRO. BD.
SW1
SW2
BATTERY
μA78540PC
LM358
2N3904
IN914
IN4001
IN4745
CD4053BE
AD542JM
CD4066BE
LM358
ANALOG TO DIG


IC2
XIC2
6500/1
P.C. BOARD P/N E1330
SW.
IC5
XIC5
LD121A
CD4025BE
IC5
XIC5
C3
.1uf
C9
.1uf
C19
4.7uf
25V
+5
R25
3.3K
R26
6.8K
Q1 2N3904
R23 22K
IC1
XIC1
ICM7211
AIPL
C11
.1uf
IC3
XIC3
CD4056
BE
C12
.1uf
IC4
XIC4
CD4054
BE
C13
.1uf
IC3A
CD4053BE
IC4
XIC4
LD120
R20
47K 1%
C10
1000 PF
R21
4.7K1%
C7
.47uf
IC12
R31
27
R29
27
R30
27
C5
.1uf
C6
.1uf
C8
.1uf
+7
+12
IC3
XIC8
REF-02
R12
22K
C17
.1uf
A9170
AL. CONV. BD.
DO NOT SCALE THIS DRAWING
MICROMITE PLUS SCHEMATIC
ESD 31153-001-00
A


ASSY NO. A9168
DISPLAY & LOGIC MICRO. BD.
ASSY NO. A9254
ANALOG TO D
BATTERY
SW1
SW2
J1
J2
P1
P2
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
IC12
LM358
TL061CP
CD4053BE
2N3904
IN914
IN4001
IN4745
μA78S40PC
LTIC12
CN8 2
R1 .47Ω 1/2 W
R2 200Ω
R3 10K 1%
R4 100K 1%
R5 2.37K 1%
R6 30Ω
R7 20K 1%
R8 10Ω 1/2 W
R9 1.96K 1%
R10 22K
R11 20.5K Ω
R12 516K 1%
R13 17.4K
R14 2K 20T
R15 18.7K 1%
R16 110K 1%
R17 10T
R18 195K 1%
R19 316.6K 1%
R21 33.3K 1%
R22 22K
R23 620K
R24 10K
R25 10K
R26 820Ω
R27 2.21Ω 1%
R28 27Ω
R31 71.5K 1%
R32 25K 1%
R33 10K 1%
C1 .47μf
C2 .1μf
C3 .1μf
C4 33PF
C5 .47μf 25V
C6 .1μf
C7 100μf 25V
C8 .1μf
C9 .1μf
C10 .1μf
C11 33PF
C12 .015μf
C13 33PF
C15 .33μf
C16 .1μf
C17 470μf 6.3V
C18 .1μf
CR1 IN4001
CR2 IN914
CR3 IN914
CR4 IN4745
CR5 IN914
CR6 IN914
Q1 2N3904
Q2 2N3904
Q3 2N3904
T1
W1
W2 620Ω 1%
W3
+5
+7
-7
+12
-12
BATT CHRG
OJ1
OJ2



Inspection Level	Revisions				
Ltr	Description		Date	Dr.	Engr.
B	SEE ECN		2/19/91		
C	ECN 17232 ADDED [illegible]		7/1/92		
D	ECN 18193 REVISED [illegible]		[illegible]		
E	ECN 18368 REVISED [illegible]		[illegible]		
F	ECN [illegible]		[illegible]		

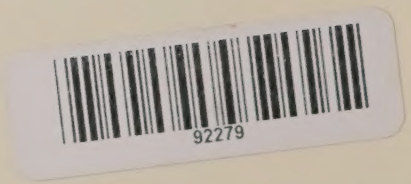
DO NOT SCALE THIS DRAWING
Tolerances (unless otherwise noted)
Decimals: x = ±.015 xx = ±.010 xxx = ±.005
Fractional ±1/64 Angles ±1/2° Remove all burrs.
Finish
Break corners and edges .010 max
All dimensions and notes to conform to ANSI Y14.5M-1982 unless specified

Dwg Made & Approved By	Draftsman	Checker	Engineer
Initial	R. CONGALTON		
Date	10/14/83		

MICRO MITE SCHEMATIC

THERMO ELECTRIC
Saddle Brook, New Jersey 07662

F-SD3115-000000 F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